

BIOLOGY OF THE RARE SKIPPER, *PROBLEMA BULENTA* (HESPERIIDAE), IN SOUTHERN NEW JERSEY

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ABSTRACT. The rare skipper, *Problema bulenta* (Boisduval & Leconte), was first recognized as occurring in southern New Jersey in 1989, although the first specimen was collected in 1983. Through the summer of 1992, it has been found in five counties along the Delaware bayshore and the Atlantic coast, with Burlington Co. the northern limit. We collected two larvae in the field on *Spartina cynosuroides* (L.) Roth (Poaceae), and reared one to maturity on the same host. Adults occur in tidal marshes containing *S. cynosuroides*, but have been observed only in the vicinity of nectar plants, not in patches of the larval host. Adults may become highly concentrated on nectar plants at some sites; we have counted as many as 121 individuals on flowers in ten minutes at one locality. It is not yet possible to say whether the New Jersey populations are secure.

Additional key words: tidal marsh, *Spartina cynosuroides*, distribution, larva, host-plant.

The rare skipper, *Problema bulenta* (Boisduval & Leconte 1833), was originally described from a John Abbot drawing based on a specimen from Georgia (Harris 1972, Miller & Brown 1981). It was not collected again until the 1920's near Wilmington, North Carolina (Jones 1926, Klots 1951). Since then it has been found further north in Virginia (Covell & Straley 1973) and Maryland (Opler & Krizek 1984). It seldom has been found in large numbers and the hostplant has not been reported. It is currently a candidate for listing as threatened or endangered under the U.S. Endangered Species Act.

In early July 1989, each of the authors collected a single female near brackish tidal marshes, one in Cape May Co. and the other in Atlantic Co., New Jersey. Subsequently, Schweitzer found a specimen among a group of papered Lepidoptera that he had collected in Cape May Co., 3-8 July 1983. The present study was undertaken to determine the distribution and biology of this little-known species in New Jersey.

METHODS

In 1990, 1991, and 1992, we conducted searches by foot and automobile in tidal wetlands along the southern New Jersey shore. Sites were selected based on similarity to the localities of our original captures, the presence of suspected hostplants, and presence of known nectar plants. United States Geologic Survey 7.5 min quadrangle maps

were used to select candidate areas. Several sites that contained very little or none of the suspected host, *Spartina cynosuroides* (L.) Roth (Poaceae), were searched: the Brigantine Division of Forsythe National Wildlife Refuge, the marshes west of Port Norris, and the Heislerville Wildlife Management Area. The first two of these were searched repeatedly.

Searches and counts were visual, sometimes aided by binoculars. At least one voucher specimen was taken for every site, and subsequently one or more individuals were netted for positive identification each time a site was visited. At no time did we collect large series; the most examples collected on any day was 9, when 121 were seen in ten minutes.

Because nearly all temperate Hesperinae feed on Poaceae or Cyperaceae, and because *Problema byssus* (Edw.) feeds on large grasses (Opler & Krizek 1984, Scott 1986), we attempted to induce oviposition by captive females and rear the resulting larvae on several species of grasses and *Scirpus* from the brackish marshes. These studies were carried out indoors at ambient temperature (18–27°C) and without humidity control. Females collected in the wild were caged with cut sections of plants and a supply of sugar or honey water. Newly hatched larvae were placed in small plastic boxes with leaves of *S. cynosuroides*, *Phragmites australis* (Cav.) Trin. (Poaceae), and two unidentified weedy grasses. The larvae were provided with fresh leaves every 24 to 48 hours. On 1 and 2 August 1990, small groups of eggs and larvae were placed in sleeves tied over single shoots of *P. australis* (1 sleeve) and *S. cynosuroides* (2 sleeves) in a brackish tidal marsh.

Searches for larvae in the field were made by walking slowly through or around patches of the suspected hosts and checking any plants that showed chewing damage on leaves. Searches were conducted in early September 1990 and in late May and early June 1991. The most thorough searches were conducted at two sites, one which had an abundance of adults in 1990 and the other where fewer adults had been seen. Areas with suspected hosts where no adults had been observed were checked as well.

RESULTS AND DISCUSSION

Distribution and Habitat

In the summers of 1990–92, *P. bulenta* was found in marshes of two streams emptying into Delaware Bay, at several widespread locations along its shore in the extensive marshes with numerous small creeks, and in two major river basins on the Atlantic coast. It is now known from Salem, Cumberland, Cape May, Atlantic, and Burlington counties.

Opler's (1992) reference to this species' occurrence in New Jersey is based on these records. It has not yet been found on the Cape May peninsula, where suitable habitats are not extensive. Cromartie searched brackish marshes along the Atlantic coast in Ocean Co. and Monmouth Co. in 1991 and 1992, but found no *P. bulenta*. In 1992, the species was reported from marshes along the Delaware Bay in Delaware (Smith & Cohen 1992).

With the exception of one specimen, all *P. bulenta* taken or observed in New Jersey to date have been in tidal marshes or on flowers in old fields within a few hundred m of such habitats. These habitats tend to be mosaics of a variety of grasses and graminoids including *Spartina cynosuroides*, *Phragmites australis*, *Scirpus* spp. (Cyperaceae), *Acorus calamus* L. (Araceae), and *Typha* sp. (Typhaceae). Some sites are essentially saltmarshes dominated by *Spartina alterniflora* Loisel., *S. patens* (Ait.) Muhl., and *Distichlis spicata* (L.) Greene (Poaceae), with less salt tolerant plants like *S. cynosuroides*, confined to upland edges and streambanks. Upstream on the larger rivers these habitats grade into freshwater tidal marshes characterized by *Zizania aquatica* L. (Poaceae), *Peltandra virginica* (L.) Kunth (Araceae), and *Pontederia cordata* L. (Pontederiaceae).

The most conspicuous forbs in these habitats are *Hibiscus palustris* L. (Malvaceae), *Kosteletzkya virginica* (L.) K.B.Presl (Malvaceae) and *Asclepias incarnata* L. (Asclepiadaceae). In early summer, there are often no nectar bearing flowers available in the marshes, but by the end of the flight season, *H. palustris* is widely available in the less saline habitats.

On 8 July 1992, a single male was collected in a garden in Port Republic, Atlantic Co., New Jersey, about 0.6 km from the nearest tidal marsh. A probable second individual was seen there on 4 August, nectaring on ornamental *Liatris spicata* (L.) Willd. (Asteraceae), an early-flowering cultivar.

Oviposition by Captive Females and Rearing Attempts

Females oviposited readily in captivity on a variety of grasses, but laid most eggs on *Spartina cynosuroides* and *Phragmites australis*. When confined with a weedy *Panicum* sp. (Poaceae) alone, they oviposited on its short, wide leaves. Females also oviposited on filter paper and the sides of containers. Generally, fewer than twenty eggs per female were obtained.

The eggs are flattened, hemispheric, about 0.6 mm in diameter, and pale cream color when newly laid, quickly becoming more yellowish. Eggs hatched in approximately eight days when kept indoors; we es-

time hatching would take a day or two longer in the field where nighttime temperatures would be lower. The newly hatched larvae are greenish white with black heads, and are about 3–4 mm long. Two or three larvae constructed small retreats near the tips of *Phragmites* leaves by folding over the edges and tying them with about seven short silk threads. The tips beyond the retreats showed chewing damage. None of the larvae survived to second instar; they appeared to have difficulty feeding on the rather tough dry leaves that were available in mid-July. The attempt to rear larvae by sleeving them was unsuccessful.

The Larva and Hostplant

Four hours' search among stands of *S. cynosuroides* on 1 and 3 September 1990 failed to uncover any larvae or retreats of the kind made by the captive larvae. An hour or two of searching near Delaware Bay, in June 1991, on *S. cynosuroides* only, produced no larvae or signs of feeding. On 29 May 1991, Cromartie found a 2.4 cm long larva in a tubular retreat on a leaf of *S. cynosuroides* growing on the edge of a road in Atlantic Co. The larva was brought into the lab and fed fresh leaves, on which it constructed a new shelter. After five days it left the plant and moved to the upper corner of the cage where it constructed a thin layer of silk and was observed to forcefully expel a small, dry fecal pellet. The larva returned to food the next day but was listless and did not appear to feed. It died on 9 June.

On 6 June, after a total of twelve hours searching over seven days, Cromartie found a second larva in a tube on *S. cynosuroides* growing next to a small bulkhead on a paved road in southern Burlington Co. This larva constructed new retreats and fed on leaves of *S. cynosuroides* in the lab until 21 or 22 June, when it sealed itself into its tube. It pupated in the last larval tube, which it probably first reinforced with additional silk. Part of the tube was cut away to prevent injury from shrinking plant tissue, but the pupa was left in place. On 6 July, a male *P. bulenta* that lacked orange scales on both forewings eclosed.

The larva (Fig. 1) is pale green with an indistinct blue-green dorsal stripe. The transverse folds of the body have darker green marks. There are paired dark spots, one pair per segment on the dorsal side and smaller pellucid dots over the entire body. The only vestiture is short white hairs on the dorsal terminal plate. The "neck" is paler and more yellow. The head is light brown with paler vertical markings and a dark brown stripe from the vertex down both sides. Our larvae are similar to, but not quite identical with, the one figured in Boisduval and Leconte (1833, plate 67).

Based on the pattern of adult occurrence as well as the two larvae found, we believe that *Spartina cynosuroides* is the primary, if not



FIG. 1. Larva of *Problema bulenta*, collected 6 June 1991, Burlington Co., New Jersey, and reared on *Spartina cynosuroides*. Photographed 11 June 1991. Length, approx. 30 mm. Emerged 6 July 1991.

only, host for *P. bulenta*. Various authors (Opler & Krizek 1984) have suggested *Zizaniopsis miliacea* (Michx.) Doell and Aschers. (Poaceae) as the host, but the northernmost occurrence of *Z. miliacea* is in Maryland. Moreover, it does not occur near the known Maryland site of *P. bulenta* (Schweitzer pers. obs.; Maryland Natural Heritage Program). *Spartina cynosuroides* occurs throughout the known range of *P. bulenta* and beyond, from Texas to southern Massachusetts (Fernald 1950, Duncan & Duncan 1987). There are stands of this grass at the Wilmington, North Carolina sites. As far as we can determine, the skipper is always found in tidal marshes where this grass is characteristic. It is a robust, rhizomatous perennial, usually 2–3 m tall. Shoots begin growing in April in southern New Jersey, and die back in late October or November, although some dry culms remain standing until the next season.

Spartina pectinata Link, which is similar to *S. cynosuroides*, occurs

on the upland side of brackish marshes and along roadsides and ditches. It, too, might be used but is probably too scarce in southern New Jersey to be an important hostplant. Moreover, it does not occur south of New Jersey (Fernald 1950, Duncan & Duncan 1987). We also consider *Phragmites australis* and the tall form of *S. alterniflora* found in brackish marshes to be potential foodplants. It is possible, however, that this skipper will prove to be monophagous on *S. cynosuroides*. Our failure to find the skipper at the Brigantine National Wildlife Refuge, at Port Norris and at Heislerville, where nectar plants, *P. australis* and *S. alterniflora* are abundant, but *S. cynosuroides* is extremely scarce or absent, supports this tentative conclusion.

Adult Seasonal Occurrence and Behavior

Problema bulenta appears to be single brooded in southern New Jersey. From 1983 to 1990, and including 1992, our earliest date for adults is 4 July and the latest is 9 August. In 1991, however, which was probably the most advanced Lepidoptera season in this century in New Jersey, adults were observed 24 June, in numbers by 26 June (J. Dowdell pers. comm.) and were declining by 15 July. Oddly, we have collected only one really fresh adult (a male, 26 July 1992) in four years; perhaps they wear quickly due to their powerful flight.

Adults are most abundant at flowers between 1000 h and 1400 h. The latest we have collected one is 1745 h. Unlike some other large skippers, adults are quite active on warm overcast days. Males and females seem to be nearly equally abundant; twenty-two males and thirty females were counted at one site on 16 July 1991. The highest single daily count was 121 in a span of ten minutes at one site on 21 July 1990. As many as fifteen adults may occur on a single inflorescence of *A. incarnata*. They are never territorial or pugnacious around flowers. The adults are so passive when visiting flowers that they can be collected without a net; the best specimens are obtained by collecting directly into a killing jar.

More than ninety-five percent of the adults observed or collected have been nectaring on flowers in or at the edges of brackish tidal marshes or in nearby fields, along rights of way, or other similar habitats. The most highly favored nectar plants are swamp milkweed (*Asclepias incarnata*) and buttonbush (*Cephalanthus occidentalis* L., Rubiaceae), but we have seen them regularly on *Hibiscus palustris*, *Kosteletzkya virginica*, *Asclepias syriaca* L. and *Apocynum cannabinum* L. (Apocynaceae), and occasionally on *Daucus carota* L. (Apiaceae), *Pontederia cordata*, *Cirsium* sp. (Asteraceae), white *Eupatorium* sp. (Asteraceae), *Centaurea* sp. (Asteraceae), *Vicia* sp. (Fabaceae) *Saponaria officinalis* L. (Caryophyllaceae), *Ipomoea* sp. (Convolvulaceae), *Trifolium pra-*

tense L. (Fabaceae), and the ornamentals *Liatrix spicata* (one sight record) and *Hibiscus syriacus* L.

There are several nectar sources frequented by other skippers in the same habitat that apparently are not utilized by *P. bulenta*. These include *Teucrium canadense* L. (Lamiaceae), a native *Lythrum* sp. (Lythraceae), and *Vernonia noveboracensis* (L.) Michaux. (Asteraceae).

Apart from those feeding on flowers, we have encountered only a few individual adult *P. bulenta* resting on *Phragmites australis* near nectar sources and one female flying near *Spartina cynosuroides*. *Problema bulenta* flies very fast and usually 1–2 m above the tall grasses, making it very difficult to follow. Schweitzer was able to observe an undisturbed individual leave a nectar site in an old field. The skipper spiralled almost straight up to about 25 m, then turned and flew over a patch of forest in the direction of a tidal marsh. One other nectaring area is largely surrounded by forest, so this behavior is probably common.

Despite hours of walking through stands of *S. cynosuroides* we have never encountered adult rare skippers there, and despite the density of adults on flowers at some sites we had little success finding larvae on *S. cynosuroides* growing near those areas. We believe that this skipper must range very widely over the brackish marsh. It may in fact be rather scarce, with adults from large expanses of marshland becoming concentrated on the few available patches of nectar plants.

Our two larvae were found on plants along roadsides, although the searches were conducted both there and in stands well away from roads, and both were on plants that were not flooded at daily high tides. The preferred oviposition site may be plants on the relatively inaccessible upland edges where the marshes generally give way to dense hardwood or white cedar swamp forests. Flooding would be less severe there than in the open areas closer to the tidal creeks and rivers.

We are not yet sure of the precise habitat requirements for this species. In particular, it is unclear why we have not found it in numbers in the Great Egg Harbor River basin, which has large stands of *S. cynosuroides*, as well as normal populations of other marsh skippers. If adults tend to congregate at a few favorable nectar sites, it may be that we simply haven't found those particular sites, although our searches have included good patches of both swamp milkweed (*A. incarnata*) and buttonbush (*C. occidentalis*).

Status of the Rare Skipper in New Jersey

Given the attention that southern New Jersey has received from lepidopterists (Shapiro 1966), it would be surprising if they missed a conspicuous species like *P. bulenta* had it been present at its current

abundance before the late 1980's. Opler (1992) suggests it might have recently expanded its range into New Jersey, possibly in response to the series of record warm years in the late 1980's and early 90's. We believe that the species has been present and merely overlooked. Phenology and habitat may have contributed to this. Collectors venturing out to search for skippers such as *Panoquina panoquin* (Scudder) and *Poanes aaroni aaroni* (Skinner) are unlikely to be in the best habitats for *P. bulenta* at the right time of year. Mosquitos, tabanids, heat, and mud might discourage collecting trips in July, when no other generally desired species could be expected.

Collectors might also fail to recognize *P. bulenta* when seen. The Delaware skipper, *Atrytone logan* (Edw.), was observed at about half the sites where we found *P. bulenta*. While some tidal marsh populations of *A. logan* are bivoltine, flying before and after *P. bulenta*, others are univoltine and fly in July, as do all known inland populations in New Jersey. It is easy to confuse the male of *P. bulenta* with the female of *A. logan* in the field if only the underside is visible. They usually can be distinguished close up by the slightly different color of the underside and the longer, more pointed forewing of *P. bulenta*. It is possible that older papered material may include *P. bulenta* misidentified as *A. logan*.

Whether or not this species has recently expanded its range northward (Opler 1992), it is now probably widespread enough to be fairly secure from human threats to its persistence. However, adults sometimes are concentrated at the few available nectar sources, which presents the possibility of market-driven overcollecting. At several sites, careless net swings and trampling could easily destroy scarce nectar plants. We feel it is best to withhold precise locality data until the status of *P. bulenta* is better understood.

On the other hand, we would strongly caution against accepting sight records for new localities. Photographs may sometimes suffice for identification, but all new records should be verified by specimens because of the possibility of confusion with *A. logan*. Certainly current populations are large enough that collection of a small series poses no threat.

Voucher Specimens

The larva and the reared male have been deposited in the Yale University Peabody Museum of Natural History, and several wild collected males and females have been sent to Yale and to the Cornell University Entomology Collection. The remainder of our southern New Jersey specimens (a total of about fifty from four counties for 1989-92, counting the donated specimens and the remains of females kept for oviposition) are in the insect collection at Stockton State College and in the personal collection of Schweitzer.

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